Tao, Zhang and Malone, International Journal of Applied Economics, 14(2), September 2017, 56-70

Talent Capital on Economic Growth: A Tale of a Chinese Megalopolis

Zhuo Tao, Xihui Zhang, and Keith D. Malone

Hohai University, University of North Alabama, and University of North Alabama

Abstract: This paper examines the contribution ratio of material capital, common human capital, and talent capital to economic growth using data from a Chinese megalopolis for the years 1993-2013. Results reveal a talent capital contribution factor which is far less than the material capital contribution factor, indicating that high levels of talent capital in the megalopolis have not translated into anticipated economic growth. To further explore this phenomenon, we calculated the industrial talent structure deviation degree. It is found that talent resources have not been effectively allocated in the market of the megalopolis, yielding various shortages and/or surpluses of talent across industry types. Therefore, we conclude that industrial structure deviation degree for talent capital directly affects the contribution level of talent capital to economic growth.

Keywords: human capital, talent capital, economic growth, contribution ratio of production factors, industrial talent structure deviation degree

JEL Classification: J11, J24, J82

1. Introduction

Economic growth has been and continues to be a topic of considerable interest for policy makers and the general public in nations around the world. For many years economists have conducted research to determine how various factors contribute to economic growth. Numerous models have been developed to investigate how varying attributes of human and physical capital impact economic growth. Lucas (1988) and Romer (1990) respectively investigate specialized human capital and human capital with special knowledge and suggest that such factors are significantly related to economic growth. Differentiated human capital promotes increased returns to scale, elevates profits, and amplifies the growth effects of other capital and labor factors. Such outcomes promote long-run economic growth. Both Lucas's (1988) concept of specialized human capital and Romer's (1990) human capital with special knowledge are conceptually close to the concept of talent capital, which is distinguishable from ordinary human capital which possesses only general knowledge.

According to these and other related studies examining the relationship between specialization and division of labor and economic growth, it can be theoretically established that increasing talent capital results in faster economic growth. However, empirical results remain mixed, yielding many questions regarding the validity of talent capital theory. One question, common to numerous areas of economics, involves the real world application of talent capital theory. Specifically, are theoretical conclusions consistent with real world outcomes? Yet another question revolves around the degree to which talent capital augments the path (or level) and velocity of economic growth. Explicitly, Freire-Serén (2001) notes that whereas various empirical studies seemingly verify the velocity issue, evidence concerning the path or level issues is not as apparent. A Chinese megalopolis has been chosen to further investigate such applications.

Based on new urban size standards in China, a Chinese city with a resident population of five to ten (5-10) million qualifies as a megalopolis (State Council of China, 2014). The megalopolis chosen for this study had a resident population of 8.19 million in 2013. In addition to the appropriate resident population level, the chosen megalopolis has several characteristics that make it a good location to study the impact of talent capital on economic growth. Four distinguishing characteristics, all derived from a data source compiled in 2013, are:

- Tenth highest GDP in China – measured at $1,293.64 billion U.S. dollars.
- Eighteenth highest GDP per capita in China – $15,851.51 U.S. dollars.
- Top five largest centers for science, technology, and education in China with approximately ten percent of residents registered as students in colleges or universities.
- Second city in China having achieved a level of higher education attainment above thirty percent (30%), with a level of 31.89%, to be specific.

Comparison of GDP and GDP per capita in 2013 indicates that any advantages associated with talent capital have not translated into economic advantages in this megalopolis. In fact, some scholars have recently considered this megalopolis to be subject to a paradox phenomenon. Zhao and Pan (2013) summarize the paradox as, “the talent resource is huge but economic growth is relatively lagging behind” (p. 15). Such a paradox indicates that theoretical implications, discussed above, are not consistent with realistic economic outcomes. As a result, two questions arise. Firstly, what is the biggest contributor to economic growth in this megalopolis? Secondly, what is preventing talent capital from transforming economic growth? The purpose of this article is to investigate these questions and shed additional light on the relationship between talent capital and economic growth.

The paper is organized as follows. A discussion of relevant literature regarding talent capital is presented next. This is followed by development of statistical methods. Results are presented following the methodology. Finally, the paper concludes with conclusion and implications of the results as well as some potential policy suggestions.

2. Literature Review

By suggesting the talent resource being the most active and eager factor among all productivity factors, Li (2011) considers talent being the best part of human resources and more broadly, the most precious of all resources. Wu and Gui (2007) conclude that talent capital is formed when talent changes from its natural form into a societal form that plays an important role in production. This occurs through strategic scientific allocation and reasonably managing the process of combining talent with other factors such as material capital and/or money capital. Talent capital is the total value of the talent itself in addition to the social and economic value generated via the combination with other factors of production. Gui *et al.* (1997) show that talent capital can be derived from talent's quantity, quality, knowledge level, and innovative ability, especially creative achievement and greater contribution.

In the early stages of formulating talent capital theory, it was theorized that human/talent capital had an enhancing effect on economic growth. Attempting to formalize such a relationship, Friedman (1955), Mincer (1958), and Schultz (1961) produced some of the initial research in this field. As talent capital research began to expand – Rosen (1983), Becker (1993), Mankiw *et al*. (1992), among many others – results indicated that a relationship between economic growth and knowledge creation based talent could not be consistently identified. For example, Mankiw *et al*. (1992) find "direct" and "robust" evidence linking talent capital and economic growth using cross-country data. Škare (2011) finds similar results when studying Croatia. On the other hand, Nonneman and Vanhoudt (1996) suggest that the evidence from Mankiw *et al*. (1992) is not as strong when considering the Organization for Economic Cooperation and Development (OECD) countries and the model is allowed to stray from the steady state. Still other researchers, Dai (2006) and Zhang (2010), conclude that the talent capital level in Europe is very high but the economy is growing very slowly.

In fact, Škare (2011) provides a reasonably detailed literature review and notes that "extensive" research on talent capital has failed to provide a clear answer. Škare (2011) continues by commenting that the ambiguity surrounding this vein of research is due to data formulation obstacles and varying methodological approaches of researchers. However, other researchers, such as Nonaka (1994), Grant (1996), Nonaka and Konno (1998), Zack (1999), and Gold *et al*. (2001), have indicated a gap between new knowledge and knowledge application. Existence of such a gap has resulted in numerous contradictions in the research. Elimination of the gap depends on systems and mechanisms which can promote the transformation of knowledge talent into productivity. Entrepreneurship is one of many avenues which aids in the application of knowledge to production. Additionally, Gui (2009) notes that Chinese scholars have proposed that talent capital's contribution factor will increase if talent structure resources can adapt to the upgrading of industrial structure.

Scholars have measured talent capital utilizing many different approaches; however, the most popular methods are based on either an input approach or an output approach. From the input perspective, talent capital measurement refers to examining economic gains which arise when human capital has a certain set of professional skills. Kendrick (1976) divides investment of talent capital into tangible investment (e.g., child raising fee) and intangible investments (e.g., education, training, medical treatment, health, safety, etc.). For example, one might seek to examine economic benefits which exist when labor obtains additional certification or skills. From the output perspective, talent capital mainly refers to economic gains which are obtained from human capital which possesses certain professional skills. Average wages of labor is the most common way to measure talent capital from the output perspective.

As noted above, talent capital may be measured in a multitude of ways; however, the years of education method is the most popular method used in China. Hu (2002) describes the years of education method as using reference indexes such as average years of education and general education level to capture the level of talent capital stock. Compared with other methods such as the cost method or the J-F income method (Jorgenson and Fraumeni 1992), the years of education method can reflect the heterogeneous characteristics of talent resources. Popularity of this methodology is also derived from availability of Chinese data. As such, the years of education method is selected as the method for estimating talent capital in this study.

Based on research referenced above and questions raised about the megalopolis in the introduction, we propose the following two hypotheses to be analyzed in this paper:

> *Hypothesis 1: If the contribution ratio of talent capital is less than material capital, then the talent resource advantage has not significantly translated into economic advantage.*

> *Hypothesis 2: When talent resources are misallocated based on requirements of the current industrial structure, the contribution ratio of talent capital to economic growth will be low.*

3. Statistical Methods

Zhu *et al.* (2009) denotes that research concerning position and contribution ratio for factors of production is typically structured by applying the Solow model (Solow 1957), constructed from the Cobb-Douglas production function (Cobb and Douglas 1928).

3.1 Solow Model

Solow (1957) introduced an exogenous technical progress factor as an improvement to the Cobb-Douglas production function. Solow’s model is shown below:

$$Y = AK^{\alpha}L^{\beta}e^{\mu} \tag{1}$$

Y represents output and A is a comprehensive efficiency constant. Variables K and L represent input factors of capital and labor respectively. Output elasticity of capital is represented by α while β is the output elasticity of labor. These output elasticity measures and the efficiency constant are parameters to be estimated. Finally, μ is a random error term.

3.2 Effective Labor Model

With the emergence and application of new economic growth models, especially as human capital’s role in economic development begins to be considered, the labor variable (L) in Model 1 can be replaced with a human capital element H. This transformation yields the effective labor model which has the following form:

$$Y = AK^{\alpha}H^{\beta}e^{\mu} \tag{2}$$

Other than H, the human capital element, all other variables are as defined previously.

3.3 Human Capital Model Classification

The next step in the progression of examining the impact of talent capital is to decompose *H*, from Model 2, into common human capital stock H_r, and specialized human capital stock H_c. Specialized human capital is also known as talent capital. Substituting this decomposition into Model 2 yields the following:

$$Y = AK^{\alpha}H_r^{\beta}H_c^{\gamma}e^{\mu} \tag{3}$$

Again all variables are as defined previously. Here, however, an additional output elasticity measure (γ) is required due to the decomposition of the labor component. β is the elasticity measure for common human capital and γ is the measure for talent capital. From Model 3, the parameters of interest to be estimated are *A*, α, β, and γ.

3.4 Variables Measurement

3.4.1 Total Output (Y)

For purposes of this study, real GDP for Nanjing from 1993-2013 has been chosen to represent total output. Nominal GDP for Nanjing is available for the study period from the *Nanjing Statistical Yearbook* (1994-2014). In order to adapt the nominal data into real GDP, we will use 1993 as the base year and use the following standard formula to complete the conversion process.

$$Real\ GDP = (Nominal\ GDP_N\ )\left(\frac{P_N}{P_{1993}}\right) \tag{4}$$

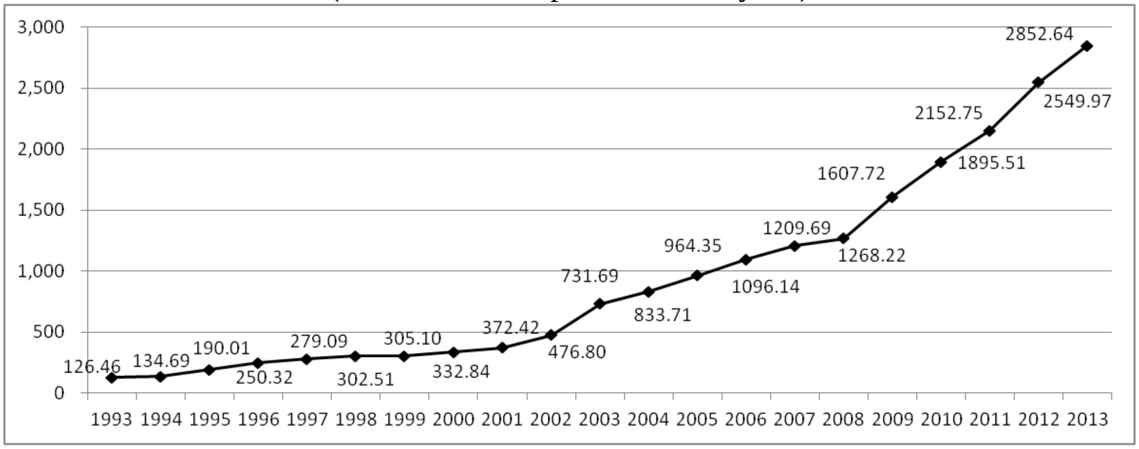
Where $Nominal\ GDP_N$ represents nominal GDP in a given year, P_N is the price in year *N* and P_{1993} is price in the base year.

3.4.2 Material Capital Input Factor (K)

Investment in social fixed assets is included as the measure for capital in the model. Since 1990, China has been publishing a yearly index of social fixed asset investment at the national level. A provincial level index is also compiled and published; however, index data is not provided at the municipal level. As such, local data for social fixed assets is obtained for the megalopolis by combining provincial data from the *Jiangsu Statistical Yearbook* (1994-2014) and additional municipal data from the *Nanjing Statistical Yearbook* (1994-2014). Once this additional data has been collected, price changes across time are eliminated by applying the social fixed asset investment price index of the province where the megalopolis is located. Again, a base year of 1993 is used when constructing the price index.

Tao, Zhang and Malone, International Journal of Applied Economics, 14(2), September 2017, 56-70

Figure 1. Trend of Real Social Fixed Assets Investment
(1993 is the base period; billion yuan)



As shown in Figure 1, social fixed asset investment (SFAI) in the megalopolis experienced significant growth beginning in 2003. SFAI growth of 254.89 billion Yuan in 2003 represents an increase of more than 72% of total SFAI growth between 1993 and 2002. Growth appeared to level off between 2004 and 2008; however, average yearly growth exceeded 100 billion Yuan during this period, which is far larger than average growth of 38.93 billion Yuan per year from 1994-2002. Growth began increasing rapidly again in 2009 with average yearly growth exceeding 300 billion Yuan between 2009 and 2013.

What factors promoted such large changes in SFAI during the study period? Overall economic conditions in China during 2002 and 2003 can explain a portion of SFAI growth during this period. Specifically, China's economic position during 2003 was better than any of the ten previous years. Growth from 2009-2013 is likely encouraged by China's "4 Trillion Plan," which sought to counter-act economic lethargy stemming from the global financial crisis that began in 2008. This plan was instigated in early 2009 and, as a result, all Chinese cities began to increase investments in fixed assets. While these are likely not the only explanations, such events undoubtedly contributed to the large changes in SFAI between 1993 and 2013.

3.4.3 Labor Input Factor ($L = H = H_r + H_c$)

Years of education (YE) methodology has been selected as the measure of human capital stock. The YE method encompasses both common human capital stock and specialized human capital (i.e., talent capital) stock. By definition, an employee in China is said to have talent if they hold a degree from a technical secondary school or above. However, for purposes of this paper, considering the actual level of social development in China, we only regard employees with college degrees or higher as possessing talent. Categories of talent capital, H_c, are defined as education years required to obtain a junior college degree, undergraduate degree, and graduate degree. These three categories are assigned values of 15, 16, and 19 respectively. On the other hand, common human capital, defined as an employee with a high school degree or less, can be broken down into the following categories: illiteracy, primary school, middle school, and high school (or technical secondary school) graduate. Associated values for H_r categories are 1, 6, 9, and 12 respectively.

Data for the labor input factor must be calculated by combining employment data for the megalopolis with educational attainment statistics. Employment data is available from the *Nanjing Statistical Yearbook* (1994-2014). Academic qualifications and educational attainment data is drawn from a variety of sources. Provincial data for Jiangsu is available from the *Chinese Labor Statistical Yearbook* (1997-2013) and data specific to Nanjing is collected from the *Nanjing Population Development Report* (2010-2013) and the *Nanjing Population Census* (2010). H_r and H_c estimates are then prepared by combining relevant data from each source.

Figure 2, below, displays levels of H_r from 1993-2013. As shown in the figure, common human capital stock experienced very limited growth between 1993 and 2004, increasing by only 186.28 million during that time frame. In fact, in 1999, H_r experienced negative growth and totaled only 1,912.49 million, which is the lowest level of H_r recorded during the study period. Figure 2 also reveals a period of rapid growth, with H_r increasing by more than 1 billion between 2005 and 2009. H_r growth began to smooth out beginning in 2010 but continued to grow throughout the remainder of the study period, although at a much lower rate.

Figure 2. Trend of Common Human Capital Stock
(million people·year)

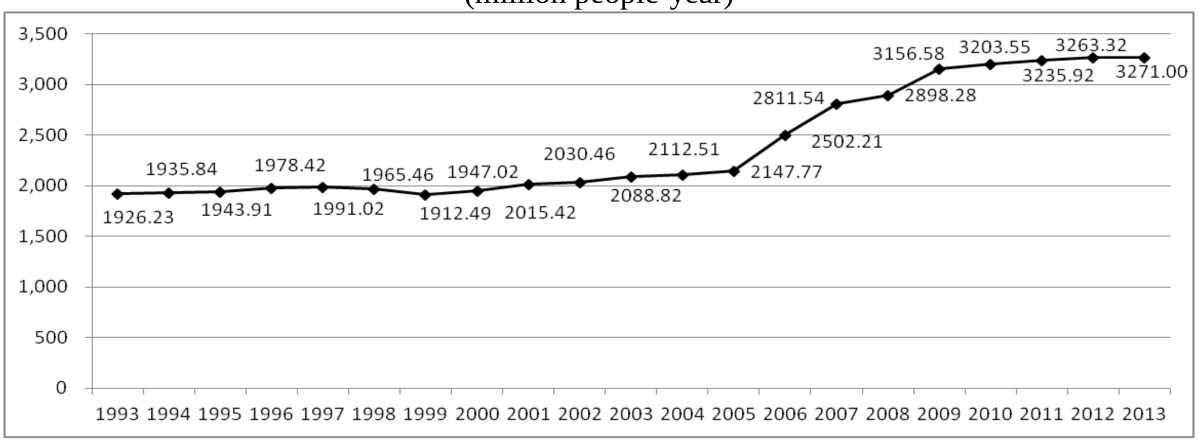
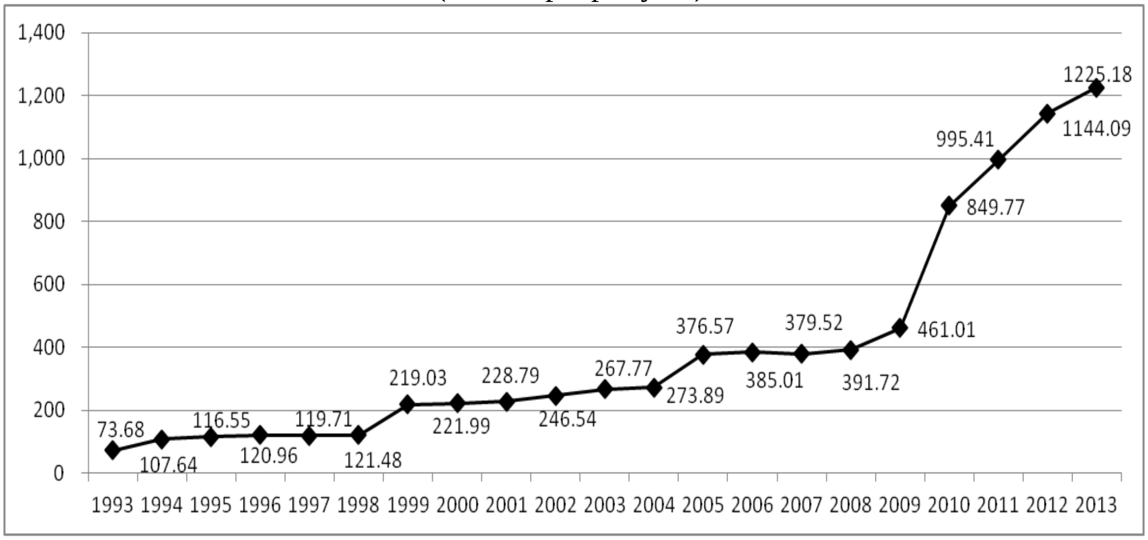


Figure 3 depicts a much different picture for talent capital in this megalopolis than the common human capital shown in Figure 2. In 1993, H_c totals only 73.68 million which is approximately 96% lower than H_r during the same year. H_c experiences significant growth between 1998 and 1999 (approximately 80%) and again between 2004 and 2005 (approximately 37.4%). Other than these two exceptions, H_c growth is fairly steady from 1993-2009. However, expanding graduate student enrollment in China results in a sharp increase in H_c after 2009. Even with this sharp increase, H_c in 2013 remains more than 60% below H_r, as indicated in Figure 3 below.

Figure 3. Trend of Talent Capital Stock
(million people·year).



4. Results

4.1 Variable Control

Interactions between factor inputs K, H_r, and H_c as well as numerous external factors will result in changes in the observed level of factor inputs. In order to examine how these factors influence economic growth rates in the megalopolis, we must add a control term. Following the work of Li (2013), we add a control variable T to adjust for variation tendency in each factor input. This control variable is constructed by observing variation tendency for each factor input from 1993-2013. When factor input stock growth falls within the typical growth variation range during a given year, T is assigned a value of 0. Oppositely, should factor growth exceed or fall short of expectations, T is assigned a value of 1. Table 1, below, identifies the normal and abnormal variations in growth for each input factor across time. Specifically, T_1, T_2, and T_3 are respective control variables for K, H_r, and H_c. Furthermore, comparison of Table 1 with Figures 1-3 reveals that abnormal growth variation (T = 1) coincides with periods decline or rapid growth discussed in the previous section. For example, T_2 = 1 during 1999 signals that the observed decrease in common human capital stock that year does not meet expectations.

Table 1. Control Variable Range

Year	Variables		
	T_1	T_2	T_3
1993-1998	0	0	0
1999	0	1	1
2000-2001	0	0	0
2002-2003	1	0	0
2004	0	0	0
2005-2008	0	1	0
2009	1	1	1
2010-2013	1	0	1

With the addition of the control variables, the model now has the following form:

$$Y_t = A(t)(e^{T_1}K_t)^{\alpha}(e^{T_2}H_{rt})^{\beta}(e^{T_3}H_{ct})^{\gamma}e^{\mu_t} \quad (5)$$

H_{rt} represents common human capital in year t while H_{ct} denotes talent capital in year t. The remaining variables and parameters are as previously defined.

Next, we perform a logarithmic transformation of the model so that it has a form suitable for straightforwardly evaluating the Cobb-Douglas elasticities. This process yields the following form:

$$LnY = LnA + \alpha LnK + \beta LnH_r + \gamma LnH_c + \mu \quad (6)$$

4.2 Model Verification

Now, *GDP*, *K*, H_{rt}, and H_{ct} data for this megalopolis can be used in regression analysis to determine values for α, β, and γ. Also, control variables T_1, T_2, and T_3 are respectively inserted into the regression equation for testing. Regression results are presented in Table 2.

Table 2. Model Regression Results

Regression analysis	Coefficient	t- test value
LOG(K)	0.588	(9.817) ***
LOG(H_r)	0.350	(2.141) **
LOG(H_c)	0.165	(2.456) **
C	-0.324	(-0.307) *
R-squared	0.994	
A.R-squared	0.993	
Durbin-Watson stat	1.034	
F-statistic	930.103	

Note: The regression analysis is carried out using SPSS 19.0. T-test statistics are reported in ( ). * * * indicates significant level within 1%, * * indicates significant level within 5%, and * indicates significant level within 10%.

As expected, regression analysis results support the notion that the level of output in the selected megalopolis is related to the level of each factor input in the megalopolis. Specifically, capital is significant at the 1% level while each type of labor is significant at the 5% level. At 0.993, the adjusted R-square and F-statistic of 930.10 indicate the model has a good fit and that the results are valid. Therefore, it can be concluded for this megalopolis that levels of factor inputs have a significant impact on output.

Coefficients for capital (α), common human capital (β), and talent capital (γ) are 0.588, 0.350, and 0.165, respectively. Substituting these into Model 6 above yields:

$$LnY = -0.324 + 0.588LnK + 0.350LnH_r + 0.165LnH_c \quad (7)$$

Then, the Cobb-Douglas production function from Model 3 can be reconstructed as:

$$Y = -0.324K^{0.588}H_r^{0.350}H_c^{0.165} \tag{8}$$

4.3 Contribution Calculation

The purpose of this section is to determine how each production factor contributes to economic growth in the megalopolis. For this calculation we will utilize a Solow surplus value algorithm model which is an internationally accepted method for calculating production factor contribution ratios. This algorithm has the following form:

$$Production\ Factor\ Contributio\ Ratio = \frac{(Factor's\ Output\ Elasticity\ of\ GDP)\,(Factor's\ Annual\ Growth\ Ratio)}{Annual\ GDP\ Growth\ Ratio} \tag{9}$$

GDP data for Nanjing indicates that the annual growth rate of real GDP in the megalopolis was 13.11% between 1993 and 2013. Annual growth rates for the individual production factors, based on factor levels from Figures 1-3 are 16.86% for capital, 2.68% for common human capital, and 15.09% for talent capital. Substituting these values into Model 9 provides the following estimates for each factor's contribution ratio:

$$Contribution\ Ratio\ of\ Material\ Capital = \frac{(0.588)(16.86\%)}{13.11\%} = 75.62\% \tag{10}$$

$$Contribution\ Ratio\ of\ Common\ Human\ Capital = \frac{(0.350)(2.68\%)}{13.11\%} = 0.07\% \tag{11}$$

$$Contribution\ Ratio\ of\ Talent\ Capital = \frac{(0.165)(15.09\%)}{13.11\%} = 18.99\% \tag{12}$$

Therefore, during the period of 1993-2013, material capital, with a contribution ratio of 75.62%, is the integral factor for economic growth in the megalopolis studied. Common human capital contributes the least amount to economic growth with a factor of only 0.07%. A contribution ratio of 18.99% indicates that talent capital far more important for economic growth than common human capital; however, capital stock is still approximately four times more significant than talent capital for generating economic growth.

5. Discussion

5.1 Rationale for Low Contribution Ratio

One possible reason for such a low contribution ratio for talent capital is a mismatch between talent resources and industry structure. Regional GDP is the sum of industry output values. Industry output values are undoubtedly related to the level of regional economic development which in turn relies on industry development. From basic economics we know that industry development is dependent upon the style of industry structure and industry optimization and upgrading. Since industry optimization and upgrading are both dependent upon the level of talent capital available for that industry, it follows that the contribution ratio of talent capital will be depressed when talent capital available does not coincide with the current industry structure.

Zhang *et al.* (2012) suggests that talent structure and industry structure should maintain a reasonably constant proportion between nations, even if nations have different levels of economic development. The event where the proportion is mismatched allows a degree of industrial talent structure deviation to be calculated. To ascertain if a mismatch between talent structure and industry structure exist in this megalopolis, we will measure the deviation of industry talent. Syrquin and Chenery (1989) developed the standard model for testing talent/industry/employment structure deviation. Specifically, we employ the following model to estimate the deviation for a single industry:

$$Industrial\ Talent\ Structure\ Deviation\ Degree\ (S_i) = \frac{Composition\ Ratio\ of\ Industry\ Output}{Composition\ Ratio\ of\ Professional\ and\ Technical\ Industry\ Talent} - 1 \tag{13}$$

When $S_i = 0$, it indicates that industry structure and talent structure are compatible, i.e., talent resources available are functional in the current industry setting. A $S_i < 0$ indicates an oversupply of talents given the current industry structure. To alleviate the deviation, talents need to be transferred to other locations or industry sectors. Oppositely, when $S_i > 0$ the economy has a shortage of talent and more talents need to be added.

Next, total industry/talent deviation can be calculated as:

$$Total\ Industrial\ Talent\ Structure\ Deviation\ Degree\ (S_i) = |Primary\ Industry\ Deviation| + |Secondary\ Industry\ Deviation| + |Tertiary\ Industry\ Deviation| \tag{14}$$

When the sum of the absolute values increases, so does the value of S_i. This signals the presence of an increased total degree of deviation in the economy.

While the composition ratio of industry output is easily obtainable, the same cannot be said regarding the composition ratio of professional and technical industry talent. In China, professional and technical personnel must register with the National Personnel Department and are required to complete national qualifying examinations. Upon completion of this process, these personnel are classified as graduates from a technical secondary school and above. Wang and Luo (2014) describe professional and technical personnel as technical personnel in enterprises or institutions which engage in professional and technical work. Management personnel who supervise employees who are required to have professional licenses or certificates are also included in professional and technical calculations. Such professional and technical workers can essentially be equated to professional human resources or talent capital.

However, industry professional and technical personnel data is not available; therefore, we utilize industrial composition of employed persons to develop the deviation degree calculations. Furthermore, we can only investigate the mismatch of talent structure to industry structure over the period from 2008 to 2013 as required employment statistics for this megalopolis were not collected prior to 2008. Table 3 below provides results for the industrial talent structure deviation degree.

Table 3. Industrial Talent Structure Deviation Degree

Year	Deviation Degree			
	Primary Industry	Secondary Industry	Tertiary Industry	Total
2008	-0.74	0.13	0.08	0.95
2009	-0.73	0.10	0.08	0.91
2010	-0.75	0.22	0.00	0.97
2011	-0.72	0.20	-0.01	0.93
2012	-0.72	0.20	-0.01	0.93
2013	-0.57	0.16	-0.05	0.78

The deviation degree for the primary industry in this megalopolis is shown in column two. Negative results for deviation degree in this industry indicate a surplus of talent in the primary industry between 2008 and 2013. Also, the larger the surplus of talent, the smaller the deviation coefficient becomes. Table 3 reveals that this surplus of talent remained steady from 2008 through 2012 indicating that primary industry talents in this megalopolis remained essentially constant during this time period. However, some primary industry talents began to be transferred outside this megalopolis or to a different industry during 2013 as the deviation degree declined to -0.57.

On the other hand, the secondary industry in the megalopolis has a positive deviation degree, signaling a shortage of talent at this industry level. In short, industry talents did not keep up with industry development. The shortage of talent reached a peak in 2010 at 0.22 and has since declined slightly to 0.16 in 2013.

Deviation degree in the tertiary industry moved from a surplus to a shortage during the study period. This industry experienced a shortage of talent during 2008, 2009, and 2010; industry talent and structure were compatible. During 2011, however, while primary and secondary industry deviation degrees were improving, the tertiary industry moved into an area of surplus talent with changes in the talent pool decreasing the deviation degree to -0.05 in 2013.

Column 5 in Table 3 reveals a decrease in the degree of total industrial talent structure deviation for this megalopolis, falling from a high of 0.97 in 2010 to 0.78 in 2013. Thus, the overall talent/industrial supply-demand misalignment is beginning to ease somewhat. Examination of talent supply and demand at each industry level reveals an imbalance which could be considered as the market not effectively allocating talent resources. In other words, the market is not playing a key role in talent capital allocation and adjustments should be made as quickly as possible to alleviate this problem.

5.2 Research Comments

Through the above analysis, it can be concluded that the contribution ratio of talent capital to economic growth is low in the selected megalopolis and the contribution of common human capital is negligible. As far as this megalopolis is concerned, investment in material capital plays a decisive role in the development of the local economy. Conclusions derived from this analysis support the existence of the paradox discussed in the Introduction section.

The principle explanation for the low efficiency of talent capital being transformed into economic growth is the surplus of talent in the primary industry in this megalopolis while the secondary industry is experiencing a shortage and the tertiary industry switches from shortage to surplus during the study period. With talent surpluses and shortages co-existing in the economy of the megalopolis, talent resources in the economy have not been effectively configured.

Comparing common human capital with talent capital it can be concluded that investment in talent capital has a much larger impact on economic growth than investment in common human capital. Improving the allocation, configuration, and management of talent capital can directly affect the contribution ratio of talent capital to economic growth.

5.3 Concluding Remarks

In conclusion, in an effort to improve the effectiveness of talent capital and efficiency of economic development, cities in China should seek to create an environment that allows talent structure to balance with industry characteristics and configuration. Such an environment will reduce the degree of total industrial talent structure deviation by allowing the market to better allocate talent capital to needed areas. Thus, talent capital's role in economic development will be maximized.

Endnotes

Zhuo Tao, Ph.D. Candidate of Human Resource Management, Department of Management & Human Resources, Business School, Hohai University, Nanjing, Jiangsu, China.

Xihui Zhang, Ph.D., Associate Professor of Computer Information Systems, Department of Computer Science & Information Systems, College of Business, University of North Alabama, Florence, Alabama, USA. Corresponding Author: *mailing:* UNA Box 5217, One Harrison Plaza, Florence, Alabama 35632, USA; *email:* xzhang6@una.edu; *telephone:* 256-765-4419.

Keith D. Malone, Ph.D., Professor of Economics, Department of Economics & Finance, College of Business, University of North Alabama, Florence, Alabama, USA.

References

Becker, G. S. 1993. *Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education* (3rd ed.). Chicago, IL: University of Chicago Press.

Cobb, C. W. and P. H. Douglas. 1928. "A Theory of Production," *American Economic Review*, 18(1), 139-165.

Dai, B. 2006. "Swinging at the Bottom of the European Union's Economy: Problems and Causes," *World Economy Studies*, 25(4), 82-88.

Freire-Serén, M. J. 2001. "Human Capital Accumulation and Economic Growth," *Investigaciones Economicas*, 25(3), 585-602.

Friedman, M. 1955. The Role of Government in Education. In R. A. Solo (Ed.), *Economics and the Public Interest* (pp. 127-134). New Brunswick, NJ: Rugters University Press.

Gold, A. H., A. Malhotra, and A. H. Segars. 2001. "Knowledge Management: An Organizational Capabilities Perspective," *Journal of Management Information Systems*, 18(1), 185-214.

Grant, R. M. 1996. "Toward a Knowledge-based Theory of the Firm," *Strategic Management Journal*, 17(2), 109-122.

Gui, Z. 2009. "Study on the Contribution Rate of Talent Capital to Economic Growth," *Chinese Talents*, 12, 10-13.

Gui, Z., K. Mei, X. Lou, and H. Jiang. 1997. "Human Resource Is the Main Source of Modern Economic Growth: Empirical Research on the Talent and Economic Growth Model," *Science and Technology Progress and Policy*, 14(5), 12-13.

Hu, A. 2002. "The Population Power Change into Human Resources Power," *Chinese Journal of Population Science*, 5(5), 1-10.

Jorgenson, D. W. and B. M. Fraumeni. 1992. "Investment in Education and U.S. Economic Growth," *Scandinavian Journal of Economics*, 94 (Supplement: Proceedings of a Symposium on Productivity Concepts and Measurement Problems: Welfare, Quality and Productivity in the Service Industries), S51-S70.

Kendrick, J. W. 1976. *The Formation and Stocks of Total Capital*. New York, NY: Columbia University Press.

Li, J. 2011. "The Exploitation Way of Talent Resource in China," *Entrepreneur World*, 2, 33-34.

Li, X. 2013. "The Trend of China's Economic Aggregate and Structure in the Next Ten Years," *China Market*, 31, 12-17.

Lucas, R. 1988. "On the Mechanics of Economic Development," *Journal of Monetary Economics*, 22(1), 3-42.

Mankiw, N. G., D. Romer, and D. Weil. 1992. "A Contribution to the Empirics of Economic Growth," *Quarterly Journal of Economics*, 107(2), 407-437.

Nonaka, I. 1994. "A Dynamic Theory of Organizational Knowledge Creation," *Organization Science*, 5(1), 14-37.

Nonaka, I. and N. Konno. 1998. "The Concept of 'Ba': Building a Foundation for Knowledge Creation," *California Management Review*, 40(3), 40-54.

Nonneman, W. and P. Vanhoudt. 1996. "A Further Augmentation of the Solow Model and the Empirics of Economic Growth for OECD Countries," *Quarterly Journal of Economics*, 111(3), 943-953.

Romer, P. 1990. "Endogenous Technological Change," *Journal of Political Economy*, 98(5), 71-102.

Rosen, S. 1983. "Specialization and Human Capital," *Journal of Labor Economics*, 1(1), 43-49.

Schultz, T. W. 1961. "Investment in Human Capital," *American Economic Review*, 51(1), 1-17.

Škare, M. 2011. "How Important is Human Capital for Growth in Reforming Economics?" *Technological and Economic Development of Economy*, 17(4), 667-687.

Solow, R. M. 1957. "Technical Change and the Aggregate Production Function," *Review of Economics and Statistics*, 39(3), 312-320.

State Council of China. 2014. Notice on Adjusting the Standard of Urban Size. http://www.gov.cn/zhengce/content/2014-11/20/content_9225.htm.

Syrquin, M. and H. Chenery. 1989. "Three Decades of Industrialization," *World Bank Economic Reviews*, 3(2), 145-181.

Wang, Y. and L. Luo. 2014. "Analysis of Professional Title Assessment on Electronic Information Engineering in Nanjing," *China Market*, 27, 163-164, 167.

Wu, L. and Z. Gui. 2007. "See the Qualified Personnel Resource to Capitalize from the Utilization Benefit of Qualified Personnel Resource: Take Shanghai as an Example," *Journal of Wuhan Institute of Chemical Technology*, 29(5), 19-21.

Zack, M. H. 1999. "Developing a Knowledge Strategy," *California Management Review*, 41(3), 125-145.

Zhang, M. 2010. *Research on Economic Growth in Europe since 1990's* (Unpublished doctoral dissertation). Graduate School of Chinese Academy of Social Sciences, Beijing, China.

Zhang, Y., J. Wu, C. Xiao, K. Zhang, and T. Liu. 2012. "Structural Deviation Degree Based on the Interaction between Emerging Industry Structure and Personnel Structure," *Science and Technology Management Research*, 32(7), 121-125.

Zhao, Y. and Y. Pan. 2013. "Nanjing Exploration: How to Transform Talent Advantage," *Guangming Daily* (March 20), 15.

Zhu, C., H. Yue, and T. Li. 2009. "An Empirical Study on Economic Growth Efficiency and Affecting Factors in China: 1985-2007," *Journal of Quantitative & Technical Economics*, 9, 52-63.